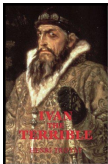


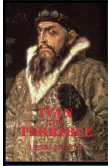
## **Hurricane Ivan Storm Impact on Pipelines and Risers**

Kevin Gaudet  
Chevron Pipe Line Company



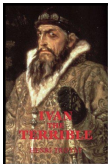
## **Hurricane Ivan Statistics**

- Formed: September 2, 2004 as Tropical Depression Nine.
- Named Tropical Storm Ivan, September 3 then Hurricane Ivan on September 5, 2004.
- Highest Wind Speed: 165 mph (270 km/h), Category 5.
- Areas Affected: The windward Islands, especially Grenada, Jamaica, Grand Cayman, Cuba, Alabama, Florida, and much of the eastern United States.
- After Ivan's rebirth, it re-entered the GOM affected Texas and Louisiana border.



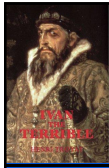
## Hurricane Ivan Effects

- September 7, 2004: Passed directly over Grenada causing major damage and loss of life.
- September 11, 2004: Passed over Jamaica causing significant wind and flood damage. (Also effecting the Cayman Islands)
- September 13, 2004: Brushed the western tip of Cuba.
- September 16, 2004: Struck the U.S. mainland near Gulf Shores, Alabama.

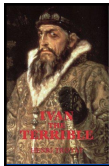
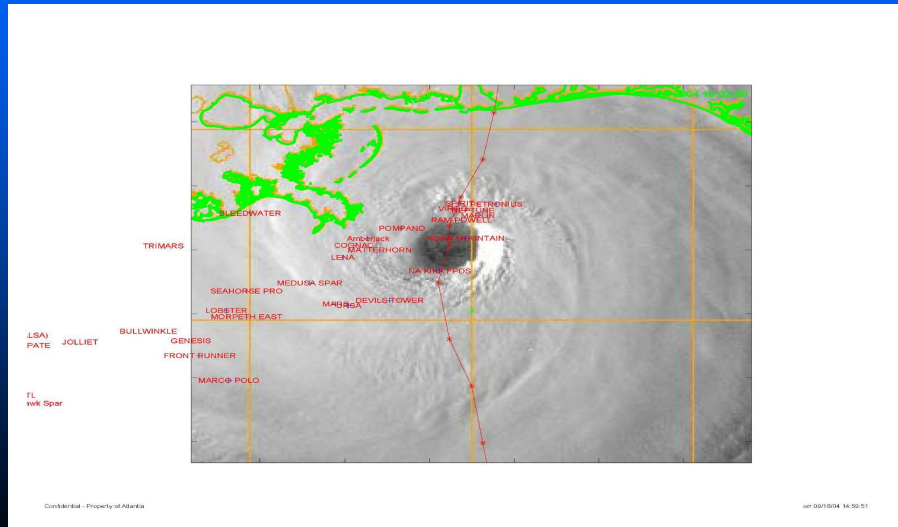


## Hurricane Ivan Effects - Continued

- September 18, 2004: Remnants of Ivan drifted off the mid-Atlantic coast and unleashed tornadoes on the east coast.
- September 23, 2004: The revived Ivan made landfall near Cameron, Louisiana.
- Ivan damaged several Oil and Gas facilities in the Gulf of Mexico.
- Pipelines and Risers in the Gulf of Mexico were moved, separated and damaged by the power of the storm.



## Hurricane Ivan Storm Track

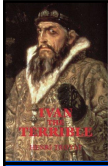


## Hurricane Ivan MMS Data – Reports of Pipeline and Riser Damage

**169 Reports of Pipeline and Riser Damage received by the MMS from Operators in the Gulf of Mexico for Liquid and Gas Pipelines.**

The compiled list contained the following information:

- 5 – Dents on Pipelines and Risers
- 7 – Kinks Reported on Pipelines and Risers
- 60 – Separations Reported on Pipelines and Risers
- 2 – Reports on Risers Pulled Up.
- 4 – Ruptures on Pipelines and Risers.
- 7 – Twisted / Bent Reports on Pipelines and Risers.



## Hurricane Ivan MMS Data - Reports of Pipeline and Riser Damage

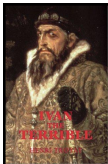
31 – “Other” Categories that range from:

- Splits in the pipelines
- Cracks in the Welds
- Exposed pipelines
- Pipeline Crossing Damage
- Pipeline Movements – (Some in excess of 1 mile)
- Riser Clamp Damage

24 – Bent Risers

25 – Unknowns

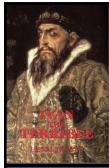
4 - Unclassified



## Hurricane Ivan MMS Data - Locations of Damage to Pipelines and Risers

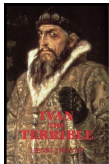
**Damage Report Locations and distance from the eye of Ivan:**

- East Cameron – 1 Report – Approx. 272 mi. West
- South Marsh Island – 3 Reports – Approx. 218 mi. West
- Eugene Island – 2 Reports – Approx. 200 mi. West
- Ship Shoal – 7 Reports – Approx. 160 mi. West
- South Timbalier - 21 Reports – Approx. 125 mi. West
- Bay Marchand – 3 Reports – Approx. 120 mi. West
- Grand Isle – 6 Reports – Approx. 110 mi. West

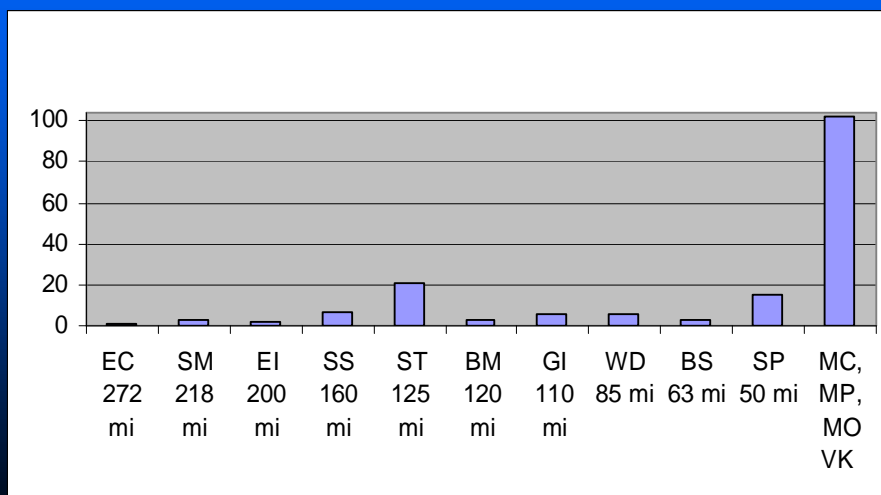


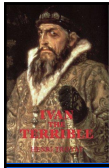
## Hurricane Ivan MMS Data - Locations of Damage to Pipelines and Risers

West Delta – 6 Reports – Approx. 85 mi. West  
Breton Sound – 3 Reports – Approx. 63 mi. West  
South Pass – 15 Reports – Approx. 50 mi. West  
Mississippi Canyon – 17 Reports – Direct Impact  
Main Pass – 73 Reports – Direct Impact  
Mobile Area – 5 Reports – Direct Impact  
Viosca Knoll – 7 Reports – Direct Impact

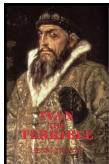
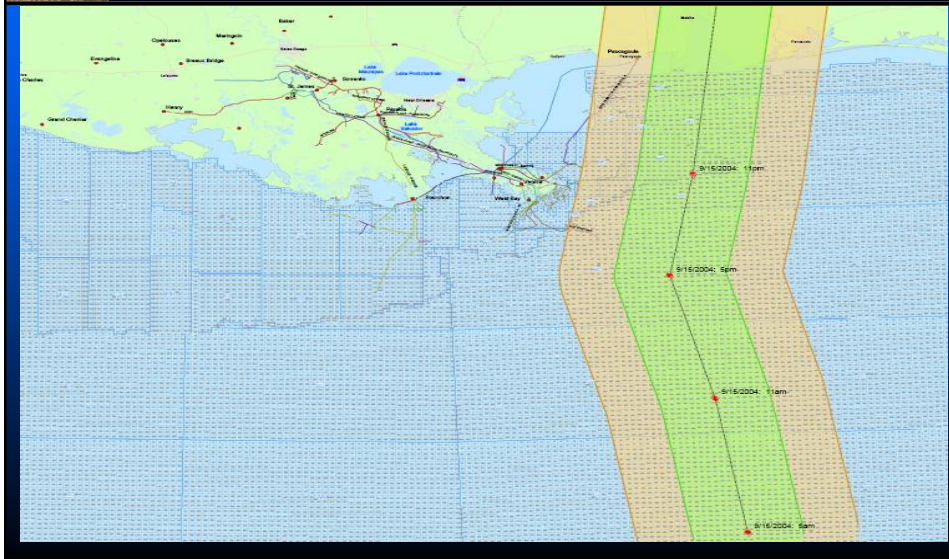


## Hurricane Ivan MMS Data - Locations of Damage to Pipelines and Risers



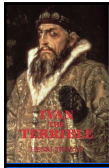


## Hurricane Ivan – Storm Track and Lease Locations



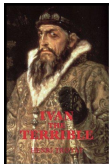
## Hurricane Ivan MMS Data - Damage Occurred

- Boarding Platform Risers Damaged – 43
- Departing Platform Risers Damaged – 45
- Platforms with Both Risers Damaged - 7
- Pipelines Damaged – 53
- Pipelines Damaged at Crossings or Pipeline Exposures- 9
- Pipelines Damaged at Subsea Tie-ins – 8
- Unknowns - 4



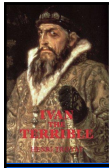
## Hurricane Ivan MMS Data - Damage Occurred

- Number of Pipelines with multiple damage locations:
  - 3 pipelines with 2 damage locations
  - 2 pipeline with 3 damage locations
- Pipeline and Riser damage reports relative to size:
  - 2" – 14" = 153
  - 16" – 36" = 16



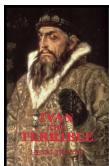
## Hurricane Ivan – Pipelines and Risers Damaged by Number and Size

Pipelines		Risers	
Size (inches)	Number Damaged	Size (inches)	Number Damaged
36	1	36	0
26	3	26	0
24	1	24	1
20	3	20	0
18	5	18	1
16	1	16	0
14	1	14	0
12	5	12	1
10	9	10	6
8	14	8	12
6	14	6	26
4	8	4	27
3	4	3	16
2	4	2	13
Total	73	Total	103

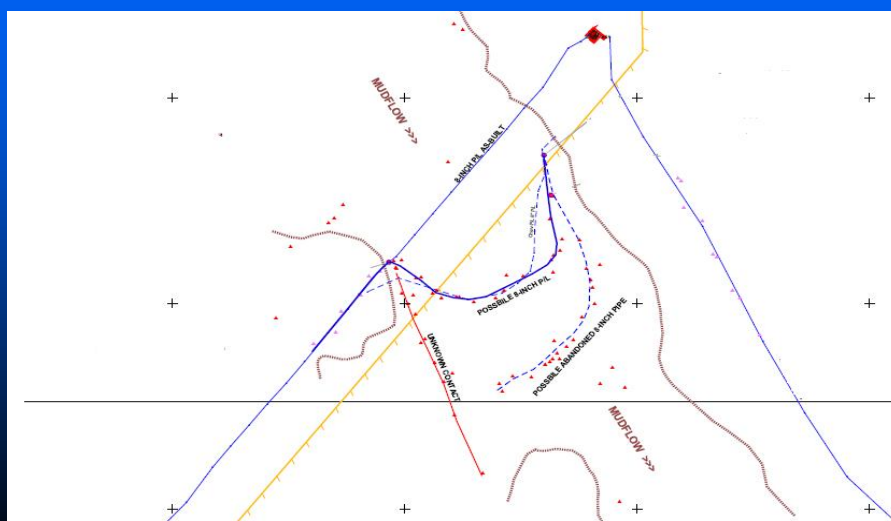


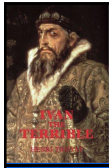
## Hurricane Ivan – Pipeline and Riser Mudslide Activity

- 21 Reports of Damage to Pipelines and Risers due to mudslides.
- Reports of damage included:
  - Separation of break away joints (safety devices designed to separate at predetermined loads).
  - Severed pipelines.
  - Pipelines moving out of the Right of Way.
  - Risers and Pipelines Damaged due to toppled platforms.

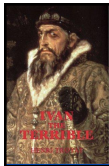
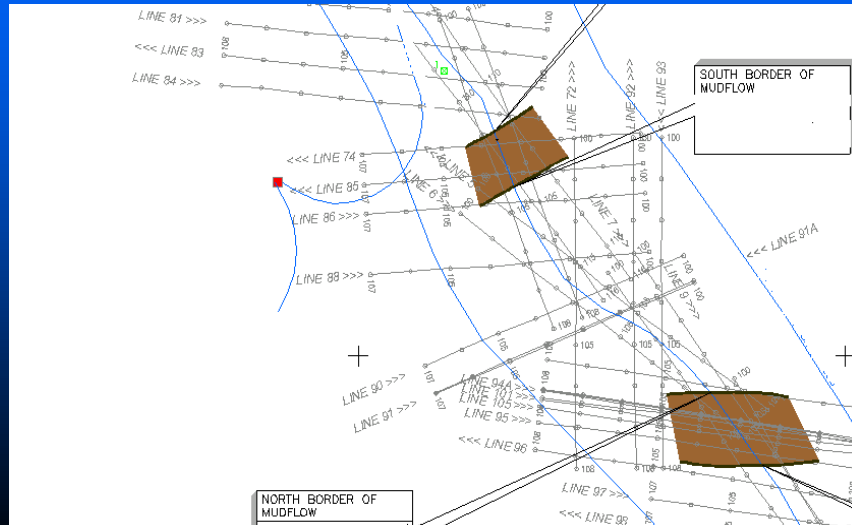


## Hurricane Ivan – Pipeline Mudslide Activity – 8" Pipeline



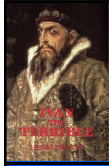


## Hurricane Ivan – Pipeline Mudslide Activity – 10" Pipeline



## Hurricane Ivan – Pipeline Mudslide Activity – 8", 10" & 20" Pipelines





## Hurricane Ivan MMS Data

Thanks to Ms. Elizabeth Komiskey with the Minerals Management Service for providing the pipeline and riser damage report information.